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A Novel Approach Using Volumetric Dynamic Airway CT to Determine Optimal Positive End Expiratory Pressure (PEEP) Settings in Neonates Requiring Long-Term Ventilator Support

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ABSTRACT BODY:
Purpose or Case Report: Positive End Expiratory Pressure (PEEP) is a key mechanical ventilator setting in neonates with bronchopulmonary dysplasia (BPD). Excessive PEEP may result in insufficient CO2 elimination and lung damage, while insufficient PEEP can result in impaired gas exchange secondary to airway and alveolar collapse. Determining PEEP settings based on clinical parameters alone is suboptimal due to the inability to titrate pressure with airway dimensions. The purpose of this study is to describe our experience using dynamic airway CT to determine the lowest PEEP setting sufficient to maintain airway patency in BPD patients requiring long-term ventilator support.
Methods & Materials: In this IRB approved study we retrospectively identified all neonatal patients with BPD that underwent volumetric CT with a dynamic airway protocol to optimize PEEP settings from December 2014 through

15. SUBJECT TERMS

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Abstract

TITLE: A Novel Approach Using Volumetric Dynamic Airway CT to Determine Optimal Positive End Expiratory Pressure (PEEP) Settings in Neonates Requiring Long-Term Ventilator Support
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ABSTRACT BODY:
Purpose or Case Report: Positive End Expiratory Pressure (PEEP) is a key mechanical ventilator setting in neonates with bronchopulmonary dysplasia (BPD). Excessive PEEP may result in insufficient CO2 elimination and lung damage, while insufficient PEEP can result in impaired gas exchange secondary to airway and alveolar collapse. Determining PEEP settings based on clinical parameters alone is suboptimal due to the inability to titrate pressure with airway dimensions. The purpose of this study is to describe our experience using dynamic airway CT to determine the lowest PEEP setting sufficient to maintain airway patency in BPD patients requiring long-term ventilator support.
Methods & Materials: In this IRB approved study we retrospectively identified all neonatal patients with BPD that underwent volumetric CT with a dynamic airway protocol to optimize PEEP settings from December 2014 through February 2017. The goal was to identify the minimal PEEP necessary to maintain a cross-sectional area (CSA) of the trachea or mainstem bronchi of at least 50-60% of the maximal CSA and prevent atelectasis. Clinical data collected included history, age, sex, initial PEEP setting, PEEP settings trialed during CT, and PEEP setting used clinically after CT. Imaging data included the CSA of the trachea and mainstem bronchi at each setting, lung parenchymal findings, CTDI and DLP.
Results: Eight neonates with BPD underwent 9 CT exams. Mean age at time of CT was 173 days (74-334 days). Additional relevant diagnoses included tracheobronchomalacia in 3 patients and pulmonary hypertension in 3 patients. Patients underwent 1-4 airway volumes spanning the trachea and mainstem bronchi at different PEEP settings with a median of 3 volumetric scans per CT exam. Average CTDI and DLP per scan were 1.48 mGy (range: 0.5-2.6) and 11.63 mGy-cm (range: 3.3-24.6), respectively. Based on the minimal pressure necessary to maintain airway patency during PEEP trials on CT, PEEP was increased in 5 patients, decreased in 1 patient, and kept the same in 3 patients.
Conclusions: Dynamic airway CT is a promising adjunct to clinical assessment to optimize PEEP settings in neonatal BPD patients requiring long-term ventilator support.
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